Infrared spectral imaging identify differences in the colloid from normal and goiterous tissues

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The thyroglobulin is a important glycoprotein produced by thyroid gland and play very significant role in the synthesis of main thyroid hormones (triiodotironine and thyroxine) that are necessary for a variety of physiologic process. Thyroid anatomy consists in a thin layer of cells (follicular cells) that produce this protein which is stored in structures known as colloids until they are needed by the body. Therefore thyroglobulin has a lot of biochemical information regarding the physiologic process inside of these cells that can indicate disorders inside of the gland that histopathology analysis cannot detect. The goal of the study is to show which are the biochemical differences between normal and goiterous patients tissue. Samples from two thyroid tissue microarray (BiomaxUS) were used throughout this study. Tissue sections for spectral data acquisition were cut into thickness of ca. 5 µm and mounted on low-e microscope slides. Infrared spectral maps were collected in transflection (transmission/reflection) mode using a Perkin Elmer Spectrum 1/Spotlight 400 (Shelton, CT) instrument that incorporate a 16 element focal plane array (FPA) detector system. The nominal pixel area projected onto a detector element was 6.25µm x 6.25µm. Raw image data sets were imported into software written in-house in the MATLAB environment. All spectra were vector normalized, noise-filtered, and corrected for water-vapour and scattering effects before being subjected to Hierarchical Cluster Analysis (HCA) to segment all spectra into classes that were correlated with histological structures obtained from images of H&E-stained parallel tissue sections. Our results show several differences in the IR spectra between normal and goiterous colloids (Fig 1). The most remarkable differences are observed on the amide I region that is related to changes in secondary structure of the protein due to iodination process. There are also differences in amide III (1200-1400 cm-1) and carbohydrates (1000cm-1-1100cm-1) regions that reveal changes in glycosylation patterns on goiterous patients. We observe the peak at 1468 cm-1 related to hormones precursors is higher in normal than goiter patients. Acknowledgement: CNPq–INFO (573916/ 2008) and CNPq (143166/2009-3; 555621/2009-0; 308277/2009-0). CAPES (9036-11-3).

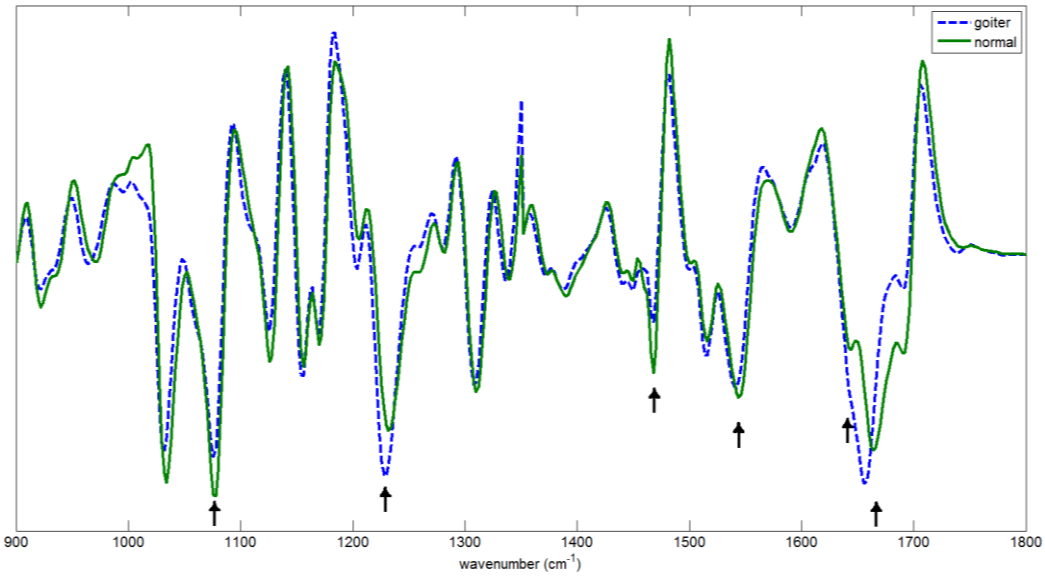

Figure 1: mean of 2nd derivative spectra from normal and goiterous patients.